Week 2 Quiz 2: Elements of Quantum Mechanics
ECE 606: Solid State Devices
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Purdue University, Spring 2013

Answer the four multiple choice questions below by choosing the one, best answer. Then ask a question about the lecture.

1) Which of the equations below is the correct time-dependent Schrödinger equation?
   a) $\frac{\hbar^2}{2m_0} \frac{\partial^2 \psi(x,t)}{\partial x^2} + U(x,t)\psi(x,t) = i\hbar \frac{\partial \psi(x,t)}{\partial t}$
   b) $\frac{\hbar^2}{2m_0} \frac{\partial^2 \psi(x,t)}{\partial x^2} + U(x,t)\psi(x,t) = \frac{\partial \psi(x,t)}{\partial t}$
   c) $\frac{\hbar^2}{2m_0} \frac{\partial^2 \psi(x,t)}{\partial x^2} + U(x,t)\psi(x,t) = i\hbar \frac{\partial^2 \psi(x,t)}{\partial^2 t}$
   d) $\frac{\hbar^2}{2m_0} \frac{\partial \psi(x,t)}{\partial x} + U(x,t)\psi(x,t) = i\hbar \frac{\partial^2 \psi(x,t)}{\partial^2 t}$
   e) $\frac{\hbar^2}{2m_0} \frac{\partial^2 \psi(x,t)}{\partial x^2} + U(x,t)\frac{\partial^2 \psi(x,t)}{\partial x \partial t} = i\hbar \frac{\partial \psi(x,t)}{\partial t}$

2) Which of the equations below is the correct time-independent Schrödinger equation?
   a) $\frac{\hbar^2}{2m_0} \frac{d\psi(x)}{dx} + U(x)\psi(x) = E\psi(x)$
   b) $\frac{\hbar^2}{2m_0} \frac{d\psi(x)}{dx} + U(x)\frac{d\psi(x)}{dx} = E\psi(x)$
   c) $\frac{\hbar^2}{2m_0} \frac{d^2\psi(x)}{dx^2} + U(x)\psi(x) = E\psi(x)$
   d) $\frac{\hbar^2}{2m_0} \frac{d^2\psi(x)}{dx^2} + U(x)\frac{d\psi(x)}{dx} = E\psi(x)$
   e) $\frac{\hbar^2}{2m_0} \frac{d^2\psi(x)}{dx^2} + U(x)\frac{d^2\psi(x)}{dx^2} = E\psi(x)$

3) How do we interpret the quantity, $\psi^*(x)\psi(x)dx$?
   a) It is the number of electrons between $x$ and $x+dx$
   b) It is the energy of the electrons between $x$ and $x+dx$
   c) It is the momentum of electrons between $x$ and $x+dx$
   d) It is the velocity of electrons between $x$ and $x+dx$
   e) It is the probability of finding an electron between $x$ and $x+dx$
Quiz: Week 2 Lecture 2: (cont.)

4) What is wavefunction of a free electron moving in the +x direction? Assume \( \Psi(x,t) = \psi(x)e^{-i\omega t} \).

   a) \( \psi(x) = Ae^{ikx} \)
   b) \( \psi(x) = Ae^{-ikx} \)
   c) \( \psi(x) = Ae^{ikx} + Be^{-ikx} \)
   d) \( \psi(x) = A\sin kx \)
   e) \( \psi(x) = A\cos kx \)

5) What question do you have about this lecture?

Turn in to Ms. Wanda Dallinger, EE-326 before 4:30 PM Friday.